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(54) Touch-type logic game

(57) An electronic game apparatus uses a unitary sheet of paperboard in which holes are preformed. Conductive paint provides both interconnection leads and is allowed to flow into the holes so that pin connections may be made to microprocessor units in multi-pin lead packages and to light emitting diode indicators. In addition, associated keyboards 13, 14 are provided by touch-type switches with a pair of leads in which contact is made by conductive paint on a membrane which is depressed by the finger. Indicators may be provided by liquid crystal material where colours are changed by the heat produced by a resistive paint on the paperboard connected to a pair of the painted conductors.

The game simulates life cycles.

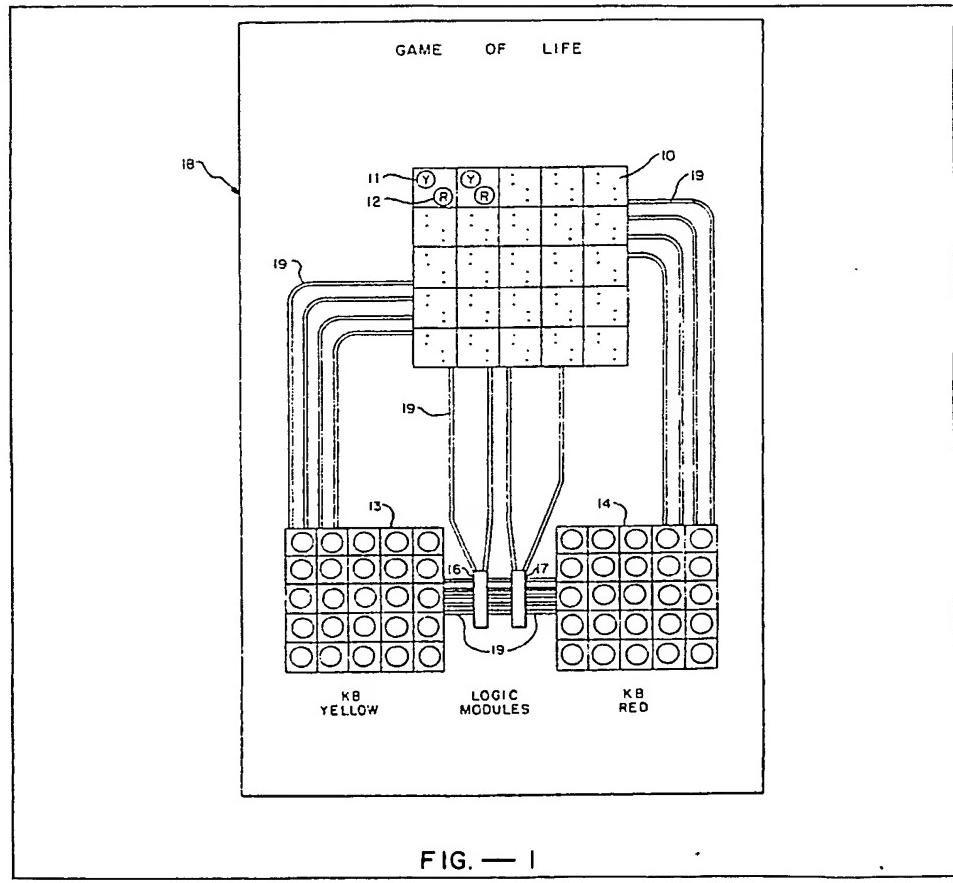


FIG. — I

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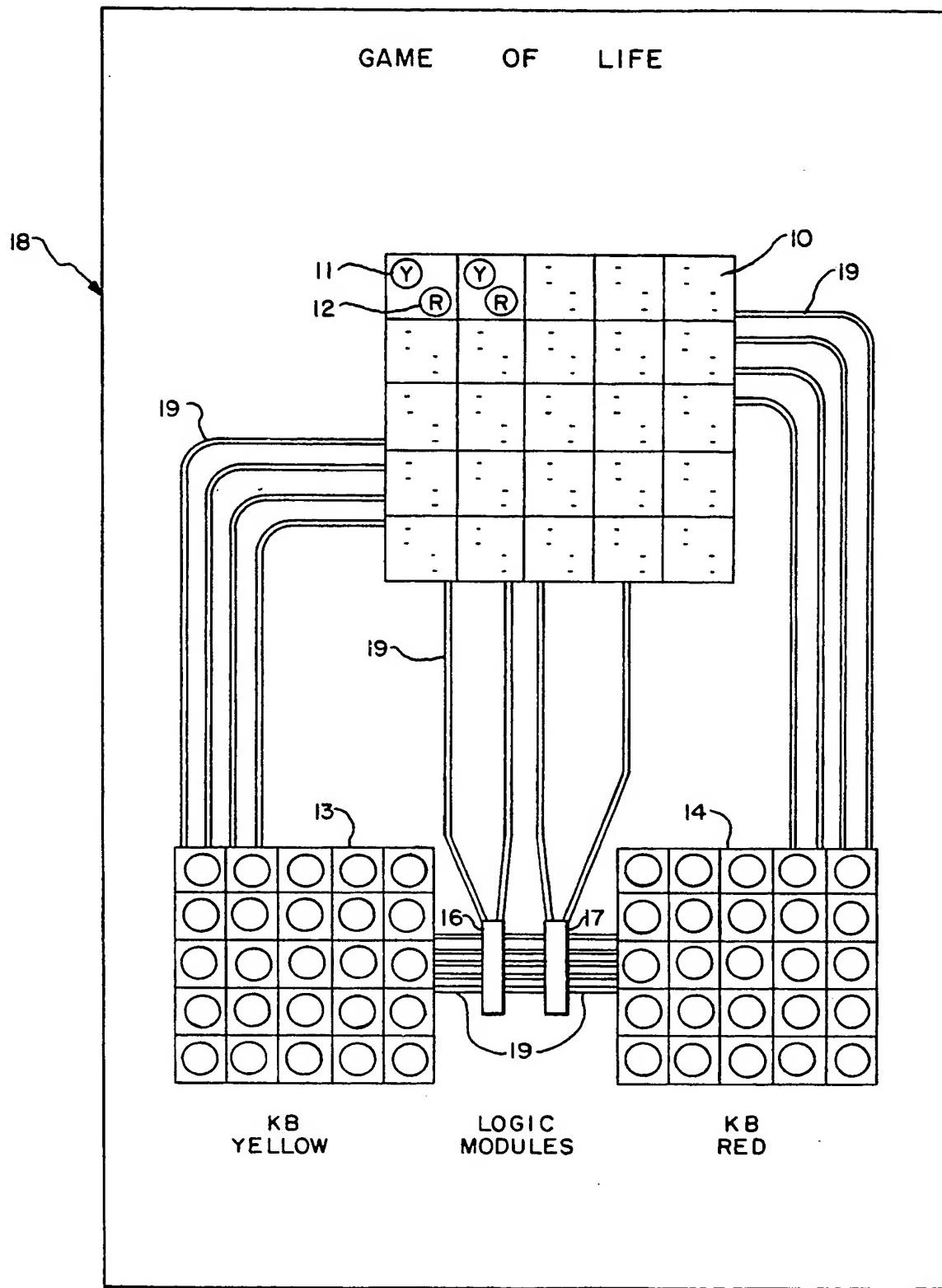


FIG. — I

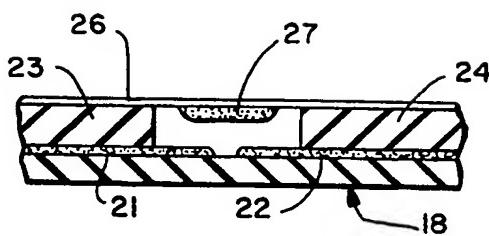
KEYBOARD

FIG. — 2

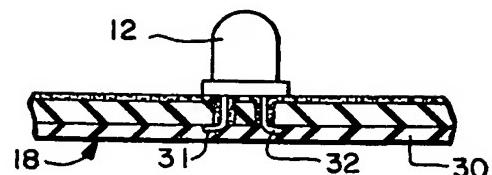
INDICATORS

FIG. — 3A

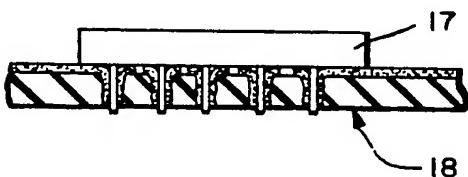
INTEGRATED LOGIC MODULE

FIG. — 4

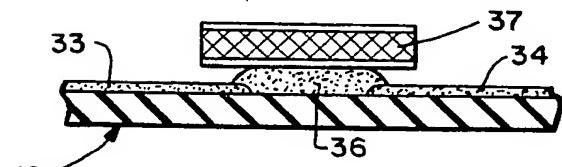


FIG. — 3B

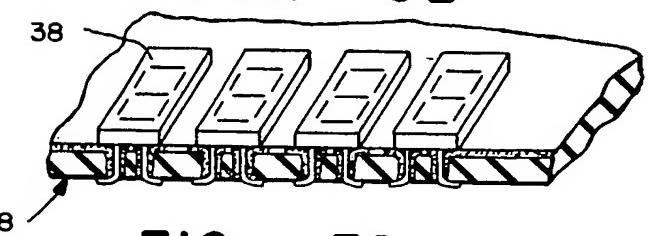


FIG. — 3C

FIG. — 5A



FIG. — 5B

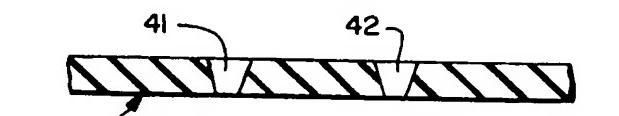


FIG. — 5C

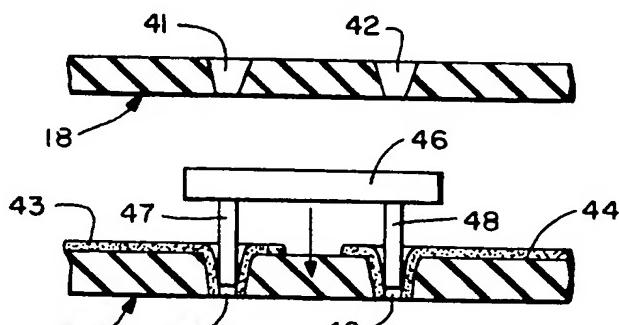
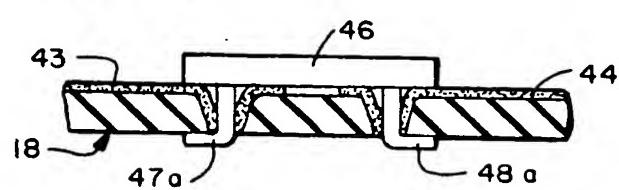


FIG. — 5D

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SPECIFICATION

Electronic game apparatus and method therefor

- 5 The present invention concerns an electronic game apparatus and method for the construction thereof. Board games have previously involved one or more players moving various markers manually on a cardboard play area in accordance with various 10 defined game rules. Some recently introduced games have also dictated moves by output of a calculator-like computer.

While it is, of course, possible to construct electronic game boards using printed circuit techniques, 15 cost is a prohibitive factor. It is, therefore, desirable to be able to construct an electronic board game which utilizes current technology such as sophisticated microprocessor logic units, LED and liquid crystal indicators and various touch actuated switches to provide a relatively large game playing 20 area all at a reasonable cost.

In accordance with one aspect of the present invention, there is provided electronic game apparatus comprising; a unitary base including a sheet of insulative paperboard; a plurality of visual indicators mounted on said sheet; a plurality of touch actuated switches mounted on said sheet; integrated circuit logic modules mounted on said sheet; and conductive leads on a surface of said 25 sheet providing circuit interconnections between said indicators, switches and logic modules.

In accordance with another aspect of the present invention, there is provided a method of constructing an electronic game on a single sheet of insulative 30 paperboard such game having components including visual indicators, touch actuated switches and integrated circuit logic modules comprising the following steps: forming holes in said sheet; applying conductive paint to form circuit leads on said sheet 35 and allowing such paint to flow into said holes; wedging the connection pins of at least some of said indicators or logic modules into said holes to make electrical contact; and bending over the pin ends to firmly affix the corresponding component to said 40 sheet.

Accordingly, the invention may provide an improved electronic game on a unitary board.

The invention is described further by way of example with reference to the accompanying drawings, in which:

Figure 1 is an elevation view of a game board embodying the present invention;

Figure 2 is a cross-sectional view of a keyboard; *Figures 3A, B and C* are cross-sectional views of 55 typical indicators;

Figure 4 is a cross-sectional view of typical integrated logic module mounted on said game board; and

Figures 5A through 5D show the method of the present invention in mounting various components.

Figure 1 illustrates a game board version of the classic game of LIFE. This is actually LIFE 2 which is described in a book entitled "101 Basic Computer Games" published 1973 by Digital Equipment Corporation with David Ahl as editor. The game as illus-

trated in *Figure 1* includes a 5 x 5 indicating matrix 10 in which each of the two players has his own symbol to represent his own piece of "life". Specifically, in the present embodiment of the game there is yellow

- 70 player and a red player with the respective light emitting diodes 11 and 12 provided in each square. Actuation of either the yellow or red indicators 11 and 12 are respectively accomplished by corresponding 5 x 5 yellow and red keyboards 13 and 14. 75 These contain 25 touch actuated switches each. The logic of the game is provided by integrated circuit logic modules indicated at 16 and 17. The indicators 11 and 12, keyboards 13 and 14 and logic modules 16 and 17 are all mounted on a unitary sheet of insulative paperboard 18. Furthermore, these components are interconnected from an electrical standpoint by leads formed by conductive paint 19. A suitable plastic graphics overlay for the entire game board would also be provided.

80 85 Very briefly the play of the game involves initial placement of three cells for each player. Successive generations are calculated by the computer based on Conway's rules which are: each cell with 0-1 neighbors dies of isolation, each cell with 2-3 neighbors survives and each cell with 4-8 neighbors dies of overcrowding. Each empty cell with exactly three neighbors will have a birth with the birth cell belonging to the player with a majority of the three. Before each subsequent generation each player adds one 90 piece to the board; in other words, actuates his yellow or red light emitting diode by actuation of the respective keyboards 13 and 14. The object is for one player to annihilate his opponent's pieces. The game continues until the opponent has no more live 95 100 pieces.

100 Figure 2 illustrates a typical touch actuated switch which is mounted on the paperboard sheet 18. A pair (or a comb) of adjacent conductive leads or specifically conductive paint 21 and 22 are deposited in 105 adjacent relationship. Spacers 23 and 24 are placed on the leads. A flexible plastic sheet 26 such as MYLAR (trademark) is affixed to the top of the spacers the plastic sheet carrying a conductive area 27 or being entirely metallized. Finger pressure is applied 110 to the area to move it into contact with the lead ends to thereby complete the electrical circuit. It is believed that such a switch per se is well-known in the art.

115 Various indicators which may be useful for the present game are illustrated in Figures 3A, 3B and 3C. Figure 3A is a red light emitting diode 12 which has a pair of pins 31, 32 which are mounted on the board 18 in a manner to be described below. A paper backing sheet provides protection and insulation.

- 120 Figure 3B is a liquid crystal indicator of the cholesteric type which changes color when heat is applied to it. Specifically on board 18 a pair of conductive leads 33, 34 pass a current through a resistive paint 36, also mounted on the board 18, which acts as a heating layer. The liquid crystal material 37, protected for example by microencapsulation, already applied for example to copper sheet, is placed over the resistive paint. The liquid crystal material is then responsive to its temperature to produce the desired 125 130 color. The general technique of making a liquid

- crystal display is well known. See the University of Illinois publication "Coloramatrix Thermally Controlled Liquid Crystal Alphanumeric Display," by Stavros Alexandros Hadjistavros, UIUCDCS-R-71-486
- 5 available from NTIS.
- Lastly as shown in Figure 3C the indicators may merely be seven segment light emitting diode displays 38 mounted on board 18.
- The indicators of Figures 3A and 3C include pin leads which are mounted on the board in a manner to be discussed below.
- 10 Lastly, Figure 4 illustrates a typical integrated circuit module 17 which, of course, is in a multilead package which is mounted on the board 18.
- 15 Specifically, all of the above pin lead devices are mounted in accordance with a method shown in Figure 5. In this method the insulative board 18 illustrated in Figure 5A is provided. Holes 41 are pierced in the board as shown in Figure 5B. The holes are
- 20 preferably tapered. Next as shown in Figure 5C conductive leads 43 and 44 are extended, for example by painting, to the holes 41 and 42 and a portion of the paint is allowed to flow into the holes. Many techniques, of course, may be utilized here including, for
- 25 example, use of a vacuum table. An integrated logic module or an LED or any type of pin unit 46 is positioned over the holes.
- Next the unit as shown with its pin leads 47 and 48 is wedged into the tapered holes, as illustrated in
- 30 Figure 5D, to make effective electrical contact. Finally to maintain the unit 46 on the board 18 the pin ends 47a and 48a are bent over. In final assembly, a paper layer is affixed to the bottom to protect the lead ends as shown in Figure 3A.
- 35 Thus in summary an improved electronic game board has been provided whereby by the use of conductive paint and preformed holes, pin type electronic modules and indicators can easily be inserted in the game board. Moreover, by the use of the conductive
- 40 paint, keyboards and liquid crystal indicators are also inexpensively and easily mounted on the board.

CLAIMS

- 45 1. Electronic game apparatus comprising: a unitary base including a sheet of insulative paperboard; a plurality of visual indicators mounted on said sheet; a plurality of touch actuated switches mounted on said sheet; integrated circuit logic modules mounted on said sheet; and conductive leads on a surface of said sheet providing circuit interconnections between said indicators, switches and logic modules.
2. Apparatus as in Claim 1 where said paperboard sheet includes preformed holes at least partially
- 50 coated with conductive paint to form a portion of said conductive leads, at least some of said indicators, switches or logic modules including pins which are wedged into said holes thereby making electrical contact.
- 55 3. Apparatus as in Claim 1 where said indicators include a layer of cholesteric liquid crystal material attached to a resistive heating layer which in turn is deposited on said sheet.
4. Apparatus as in Claim 1 where said touch
- 60 65 actuated switches include a pair of adjacent conduc-

tive lead ends on said sheet and a juxtaposed flexible sheet carrying a conductive area movable by finger pressure into contact with said lead ends to thereby complete an electrical circuit.

- 70 6. A method of constructing an electronic game on a single sheet of insulative paperboard such game having components including visual indicators, touch actuated switches and integrated circuit logic modules comprising the following steps:
- 75 forming holes in said sheet; applying conductive paint to form circuit leads on said sheet and allowing such paint to flow into said holes; wedging the connection pins of at least some of said indicators or logic modules into said holes to make electrical contact; and bending over the pin ends to firmly affix the corresponding component to said sheet.
7. Electronic game apparatus substantially as herein described with reference to the accompanying drawings.
- 80 8. A method of constructing an electronic game, substantially as herein described with reference to

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